Lesson 1.5 Negative Exponents (Day 2)

Objective

*Understand zero and negative exponents

*Simplify expressions involving zero and negative exponents

- **Common Core State Standards** *8.EE.1*
- **Mathematical Practices** 4. Model mathematics. 5. Use tools strategically. 6. Attend to precision.

Lesson 1.5 Negative Exponents (Day 2)

Understanding Negative Exponents

STEP 1 Use the quotient of powers property to simplify each expression. Write the quotient in exponential notation.

Expression	Power
$\frac{4^5}{4^3}$	4^2
$\frac{4^5}{4^4}$	?
$\frac{4^5}{4^5}$	?
$\frac{4^5}{4^6}$	?
$\frac{4^5}{4^7}$	?

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$\frac{4^5}{4^4}$	?
$\frac{4^5}{4^5}$	?
$\frac{4^5}{4^6}$	?
$\frac{4^5}{4^7}$	?

What expression did you write for $\frac{4^5}{4^6}$? What exponent did you use?

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Understanding Negative Exponents

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$\frac{4^5}{4^4}$	?
$\frac{4^5}{4^5}$	?
$\frac{4^5}{4^6}$	?

STEP 2 In factored form, the quotient $\frac{4^5}{4^6}$ is $\frac{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4}{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4}$. If you divide out all the common factors in the numerator and denominator, what is the value of $\frac{4^5}{4^6}$?

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$\frac{4^5}{4^4}$	?
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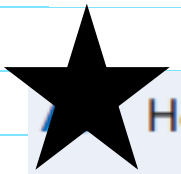
Lesson 1.5 Negative Exponents (Day 2)

What is a negative exponent?

For any nonzero real number a and any integer n,

$$a^{-n} = \frac{1}{a^n}, \; a \neq 0$$



A How is a power with a negative exponent written as an equivalent power with a positive exponent? Use an example to demonstrate. Possible answers: $2^{-1} = \frac{1}{2^1}$; $5^{-2} = \frac{1}{5^2}$

Lesson 1.5 Negative Exponents (Day 2)

Simplify each expression. Write your answer using a positive exponent.

Example 23

a) $13^{-4} \cdot 13^{7}$

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Simplify each expression. Write your answer using a positive exponent.

a) $13^{-4} \cdot 13^{7}$

Method 1

$13^{-4} \cdot 13^{7}$

$= \frac{1}{13^{4}} \cdot 13^{7}$ Write using a positive exponent.

$= \frac{13^{7}}{13^{4}}$ Simplify.

$= 13^{7-4}$ Use the quotient of powers property.

$= 13^{3}$ Simplify.

Method 2

$13^{-4} \cdot 13^{7}$

$= 13^{-4+7}$ Use the product of powers property.

$= 13^{3}$ Simplify.

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Simplify each expression. Write your answer using a positive exponent.

Example 23

b) $\dfrac{x^{-7}}{x^{4}}$

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Simplify each expression. Write your answer using a positive exponent.

Example 23

b) $\dfrac{x^{-7}}{x^4}$

Solution

$$\frac{x^{-7}}{x^4} = \frac{1}{x^7} \cdot \frac{1}{x^4}$$ Write using a positive exponent.

$$= \frac{1}{x^{11}}$$ Simplify.

Lesson 1.5 Negative Exponents (Day 2)

Simplify each expression. Write your answer using a positive exponent.

Example 23

c) $9m \div 3m^{-2}$

Math Note

For $3m^{-2}$, only m is raised to the power of -2. For $(3m)^{-2}$, both 3 and m are raised to the power of -2.

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Simplify each expression. Write your answer using a positive exponent.

Example 23

c) $9m \div 3m^{-2}$

Math Note

For $3m^{-2}$, only m is raised to the power of -2. For $(3m)^{-2}$, both 3 and m are raised to the power of -2.

Solution

$9m \div 3m^{-2}$

$= \frac{9m}{3m^{-2}}$ Write the division as a fraction.

$= \frac{9}{3} \cdot \frac{m}{m^{-2}}$ Rewrite the fraction as the product of two fractions.

$= 3 \cdot m^{1-(-2)}$ Use the quotient of powers property.

$= 3m^3$ Simplify.

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Your Turn

4 $2.5^{-7} \div 2.5^{-4}$

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Your Turn

4 $2.5^{-7} \div 2.5^{-4}$

$2.5^{-7} \div 2.5^{-4} = \underline{?}$ Use the ___?___ of powers property. $(2.5)^{-7-(-4)}$; quotient

$= \underline{?}\ (2.5)^{-3}$ Simplify.

$= \frac{?}{?}\ \frac{1}{2.5^3}$ Write using a ___?___ exponent. positive

$= \underline{?}\ 0.064$ Evaluate.

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Your Turn

5 $\dfrac{(-6)^3}{(-6)^4}$

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Your Turn

5 $\dfrac{(-6)^3}{(-6)^4}$

5 $\dfrac{(-6)^3}{(-6)^4}$

$\dfrac{(-6)^3}{(-6)^4} = \dfrac{?}{} \; (-6)^{3-4}$ Use the ? of powers property. quotient

$= \dfrac{?}{} \; (-6)^{-1}$ Simplify.

$= \dfrac{?}{?} \; \dfrac{1}{-6}$ Write using a ? exponent. positive

$= \dfrac{?}{?} \; -\dfrac{1}{6}$ Simplify.

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Your Turn

6 $14a^{-5} \div (7a \cdot 2a^{-4})$

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Your Turn

6 $14a^{-5} \div (7a \cdot 2a^{-4})$

6 $14a^{-5} \div (7a \cdot 2a^{-4})$

$14a^{-5} \div (7a \cdot 2a^{-4}) = \frac{?}{?}$ Write the expression as a ___. $\frac{14a^{-5}}{7a \cdot 2a^{-4}}$; fraction

$\frac{14}{7 \cdot 2} \cdot \frac{a^{-5}}{a \cdot a^{-4}} = \frac{?}{?} \cdot \frac{?}{?}$ Rewrite the fraction as the product of two fractions.

$\frac{14}{14} \cdot \frac{a^{-5}}{a^{1+(-4)}} = \_\_? \_\_ \cdot \_\_? \_\_$ Use the ___ of powers property to the denominator. product

$1 \cdot a^{-5-(-3)} = \_\_? \_\_ \cdot \_\_? \_\_$ Use the quotient of powers property to the resulting new fraction.

$= \_\_? \_\_$ Simplify. a^{-2}

$= \_\_? \_\_ \frac{1}{a^2}$ Write using a ___ exponent. positive

Lesson 1.5 Negative Exponents

Independent Practice #9-14 & 16-20

Name:_____ Period_____

Practice 1.5

Simplify each expression. Write your answer using a negative exponent.

9. $7^3 \cdot 7^{-4}$

10. $\frac{(-5)^{-2}}{(-5)^3}$

11. $\left(\frac{3}{4}\right) \div \left[\left(\frac{3}{4}\right)^0 \cdot \left(\frac{3}{4}\right)^2\right]$

12. $\left(\frac{2}{5}\right)^{-4} \cdot \left(\frac{2}{5}\right)^{-1} \div \left(\frac{2}{5}\right)^{-3}$

13. $\frac{x^0}{x^2 \cdot x^3}$

14. $\frac{4h^{-5} \cdot 6h^{-2}}{3h^{-3}}$

Simplify each expression. Write your answer using a positive exponent.

16. $5.2^{-3} \div 2.6^{-3}$

17. $\frac{(-3)^{-4}}{(-3)^2}$

18. $\left(\frac{5}{6}\right)^{-4} \cdot \left(\frac{5}{6}\right)^{-2} \div \left(\frac{5}{6}\right)^{-3}$

Homework #1-8

Name:_____ Period_____

Wednesday Homework

Lesson1.5 #9-20

Simplify each expression. Write your answer using a negative exponent.

9. $6^{-8} \cdot 6^3$

10. $\frac{(-9)^{-4}}{(-9)^4}$

11. $\frac{5}{6} \div \left[\left(\frac{5}{6}\right)^7 \cdot \left(\frac{5}{6}\right)^0\right]$

12. $\left(\frac{3}{8}\right)^{-5} \cdot \left(\frac{3}{8}\right)^{-2} \div \left(\frac{3}{8}\right)^{-1}$

13. $\frac{y^0}{y^4 \cdot y^3}$

14. $\frac{7p^{-6} \cdot 6p^{-3}}{3p^{-5}}$

Lesson Check #10 and 19 (can simplify expression containing numbers with a negative exponent)